BB7 user manual

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Introduction

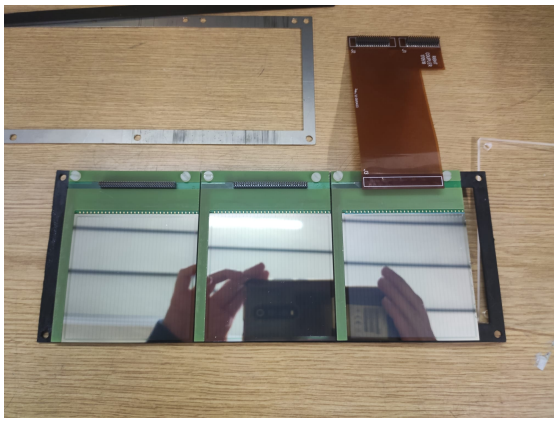

Figure 1: BB7 detectors holding in the dummy support structure.

For the incoming DESPEC Phase-0 campaigns of 2024 and 2025, a new layer of DSSSD detectors, so-called DINTESPEC demonstrator, is being developed. DINTESPEC consists of three BB7 double-sided silicon strip detectors (DSSSD) from MICRON Semiconductors Ltd [1]. Each detector has an active are of 64×64 cm^2, with 32 vertical and 32 horizontal strips 2-mm wide, providing 1024 pixels with 4-mm^2 area for position determination of implanted ions and β electrons. The wafers are mounted in customized packages to fit the AIDA triple-wafer snout dimensions. Fig. 1 shows the three detectors in a dummy support frame.

In total, DINTESPEC will comprise 96 front and 96 back strips to provide x and y position information, and will be placed behind two AIDA BB18(DS)-1000 24cm × 8cm "triple" wafers. The two detectors will be sandwiched between two fast-plastic scintillation detectors providing excellent timing resolution for electrons.

During the 2024 and 2025 campaigns, DINTESPEC is intended to be used with an alternative electronics system. This is described in the next section.

Electronics

Each BB7 detector is powered by a MHV-4 power supply (maximum voltage: 400V). The detector is connected through an AIDA kapton PCB and two custom-made cables to two Mesytec MPRL pleamplifiers, which have a linear scale up to 2.5 MeV or 10 MeV and a logarithmic one up to 3 GeV. At present, we select 2.5-MeV sensitivity for the junction side and 10-MeV sensitivity for the ohmic side. We bias the junction side. In this configuration, a 50-Ohm termination should be inserted in the HV input that is not used.

The outputs of the preamplifiers are connected through the 34-pin RISING cables to four STM-16+ shaping amplifiers. The thresholds of the STM-16+ should be adjusted with the Trs. screw. No signal should be connected to the modules for threshold adjustment. The lower multiplicity threshold has to be set to 1 and the higher multiplicity threshold to infinite. The Trs. screw should be adjusted until a single positive logic signal is seen in the scope (image).

[NOTE]: some STM-16+ have a logical gate of 500 ns and others of 20 ns, how can these gates be changed?)

The STM-16+ can be configured in gain and threshold with Mesycontrol (see next section). Shaping time is 5 μs. The addresses have been set to 2, 3, 5 and 8. They are also used to bias the MPRLs.

The output signals of the STM-16+ are sent to two CAEN V785 (VME) modules via 34-pin twisted-pair cables. Each V785 has two common gates. The logical gate to accept data is generated with an LRS model

[1] https://www.micronsemiconductor.co.uk/

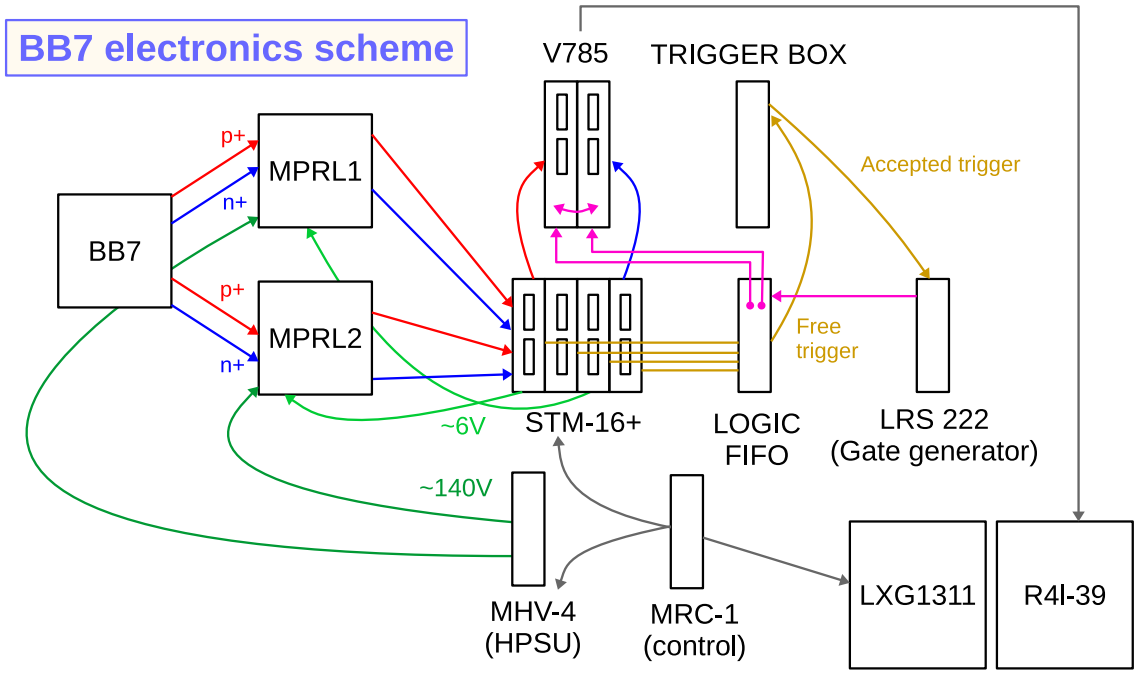

Figure 2: Schematics of the BB7 electronics chain used for the DESPEC experimental campaign of 2024.

222 dual gate generator and input in to the two V785. A daisy chain is done to send the gate to the two modules (is it necessary?). In not used, the free gate inputs of the V785 modules should be terminated with 50 Ohm. The addresses of the two V785 modules are set to 3 and 4, respectively.

Control of MHV-4 and STM-16+ modules

The control of the Mesytec modules is managed by the MRC-1 module of Yoshiki Tanaka. The BB7 bus is number 1. This bus is connected to:

- 0 MHV-4_20
- 2 STM-16+
- 3 STM-16+
- 5 STM-16+
- 8 STM-16+

To start the MRC mesycontrol server, login to computer lxg1311, user profi (password: WM2014 * * * * * * * 22 * *):

$ ssh -XY profi@lxg1311

Open the mesytec screen used for bb7:

$ screen -xS mesy_bb7

Check if the mesycontrol server is active, if not, start with:

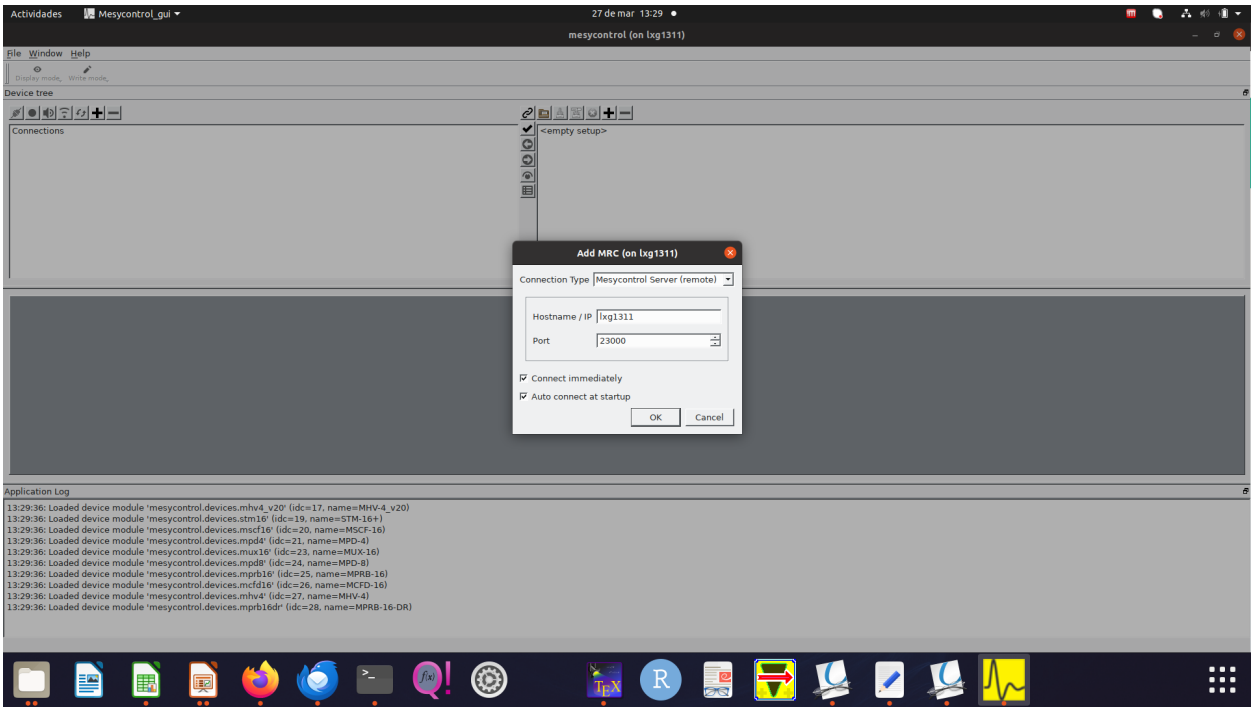

Figure 3: Mesycontrol gui showing the connection panel.

$ ./mesycontrol_server –mrc-serial-port=/dev//ttyUSB1

To manage the MRC-1, in another tab, connect to lxg1265 (same pwd as lxg1311):

$ ssh -XY profi@lxg1265

Move to the Mesytec folder:

$ cd /u/profi/mesycontrol-1.0.6.1-x86_64

Run **mesycontrol_gui**:

$ ./bin/mesycontrol_gui

The gui will be opened. Click the (+) button in the top left panel (connections). A display like the one shown in Fig. 3 will appear.
Type the following options:

Connection type: **Mesycontrol server (remote)**
Hostname / IP: **lxg1311**
Port: **23000**

You will connect to the MRC-1. The BB7 bus is number 1. To charge the configuration file, click on the folder image at the top right panel of the screen (see Fig. 3). Go to:

/u/profi/BB7/name_file.xml

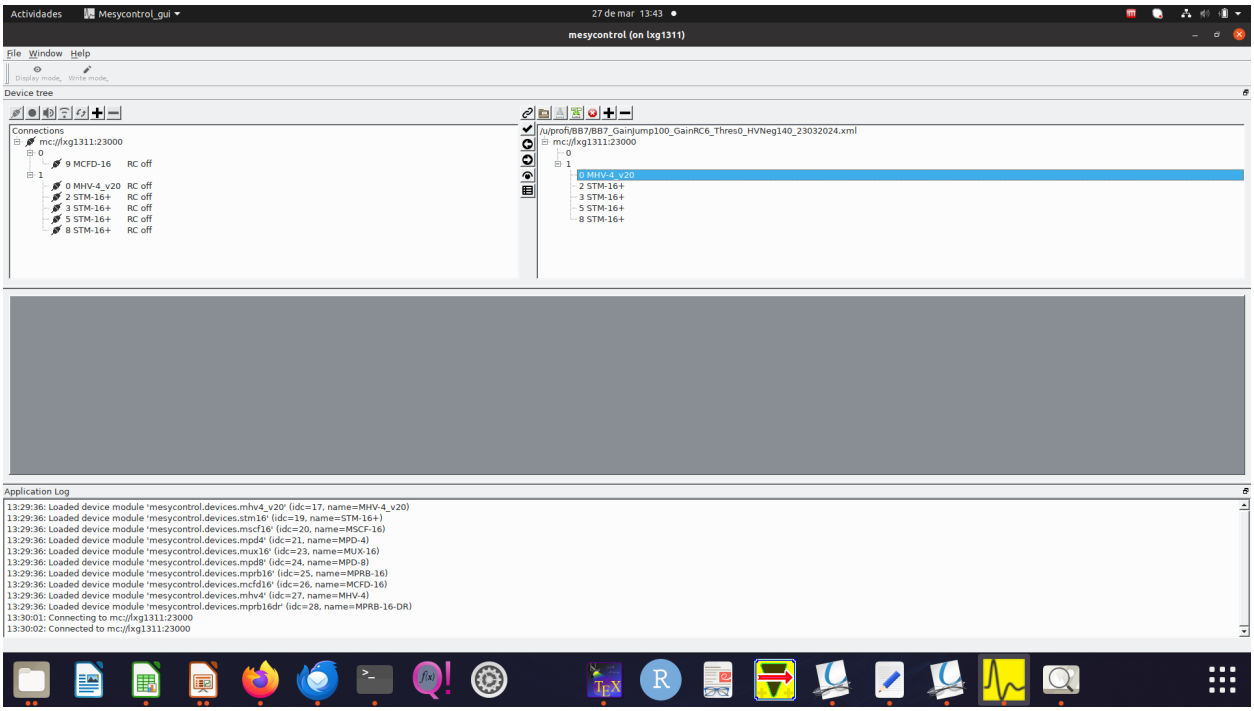

Figure 4: Mesycontrol gui showing the configuration file loaded on the top right panel of the screen.

To load the configuration, select each module appearing on the right and click on the button (←) that appears between the top tabs (see Fig. 5). You will have loaded your saved configuration in your current connection.

Follow the manual (https://www.mesytec.com/downloads/mesycontrol/mesycontrol.pdf.) to modify, refresh, and save parameters. You can change parameters in the gui (see Fig. **??**).

If you want to save a new configuration file, click on the third button of the top right screen (the one showing the green downward arrow, see Fig. 5).

To disable **mesycontrol**, click on the right button of the mouse on top of each device at the top left panel (connections) and select the option "disable RC".

To remove the setup configuration, click on the button (-) on top of the top right panel.

BB7 MBS DACQ

To run the BB7 DACQ, connect to server R4L-39:

$ ssh despec@r4l-39 (password: S18at****)

Move to BB7 folder with the shortcut "bb7" (This will bring you to **/frs/usr/despec/mbsrun/s100/bb7_vme**):

$ bb7

Before connecting to MBS, type:

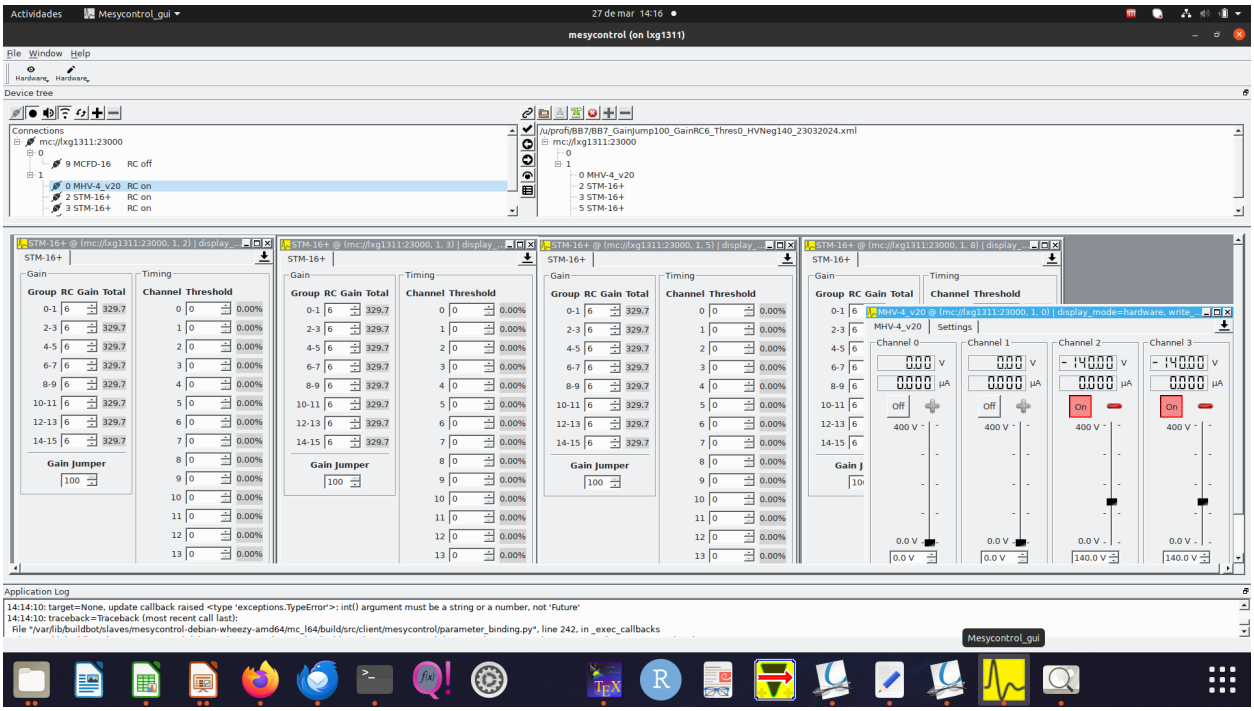

Figure 5: Mesycontrol gui showing the display screens for each loaded module.

$ resl
$ resl

Then conenct to MBS:

$ mbs

To start the DACQ type:

@startup

To check that the DACQ is running, type :

ty ev -v

or:

sh ra 1 (shows rates in 1 second)

[NOTE]: You can open another session in r4l-39 and type "rate" to check that the dacq is running.

To open an lmd file, get back to the MBS screen and type:

@fsq
@open

To close it:

@close

An lmd file called:

/lustre/despec/bb7_files/test_trg_210324_00XX_0001.lmd

will be generated. It will be accessible from any despec computer at the **/u/despec/** folder.

To properly close mbs type:

@shutdown
exit

C4ROOT

Connect to any despec computer:

$ ssh -XY despec@lxpool.gsi.de (password: Curryw******)

Check that **lustre** is mounted, if not use the shortcut "lustre":

$ lustre

Move to folder **/u/despec/lustre/despec/bb7_files/code/build**:

$ cd /u/despec/lustre/despec/bb7_files/code/build
$ rm -rf *
$ cmake ../c4root
$ . ./config.sh
$ make -j

Then, move to folder **/u/despec/lustre/despec/bb7_files/code/c4Root/macros/tests**:

$ cd /u/despec/lustre/despec/bb7_files/code/c4Root/macros/tests

Open macro **run_bb7_online.C** and change the names of the input lmd (line 74) and output root (line 75) files.

Run the macro:

$ root -b run_bb7_online.C

A root file with the WR timestamp and raw energy info will be generated in folder **/u/despec/lustre/despec/bb7_files/**

$ cd /u/despec/lustre/despec/bb7_files/root_trees
$ ls -lhtr

Last root file should be the one you have generated.

[NOTE]: if you make changes in the unpacking code for BB7 (**/u/despec/lustre/despec/bb7_files/code/c4Root/unpack**
you should recompile the unpacker:

```
$ cd /u/despec/lustre/despec/bb7_files/code/c4Root/unpack/exps
$ make bb7 -j
```